

Injuries among Youth Living on Farms in the United States, 2006

Kitty J. Hendricks NIOSH, Morgantown, WV

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The findings and conclusions in this report are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Abstract

Objective: Children in agricultural environments are exposed to numerous hazards. In order to address this issue, the National Institute for Occupational Safety and Health (NIOSH), through an interagency agreement with the U.S. Department of Agriculture, National Agricultural Statistics Service (NASS), established the Childhood Agricultural Injury Survey (CAIS) surveillance system. CAIS data have previously been released for the years 1998, 2001, and 2004. Data for calendar year 2006 have just become available.

Methods: The 2006-CAIS was based on a telephone interview of 50,000 randomly selected U.S. farm households. The 2006-CAIS collected information on nonfatal injuries to youth less than 20 years of age on farms for the 2006 calendar year. CAIS includes both work and non-work injuries occurring to youth living on, working on, or visiting the farm. In addition to injury information, prevalence data were also collected on household youth exposure to work, horses, all terrain vehicles (ATVs), and tractors. For the purposes of this report, only the results for household youth will be presented.

Results: Preliminary results indicate that there were about 1.1 million youth living on U.S. farms in 2006. In that same year, an estimated 11,654 farm-related injuries were reported for these youth. (rate: 10.4/1,000 household youth). Sixty-six percent (7,678) of the injuries were to household males, and 5,790 (50%) of the injuries occurred to youth between the ages of 10 and 15 years. A large proportion of the injuries occurred on livestock farms (7,493), and 31% of the injuries were work-related.

More detailed results of injuries, exposures, household demographics, and injury rates from the 2006-CAIS will be presented. This examination will also provide a comparison to results from the 1998, 2001 and 2004 CAIS conducted for NIOSH by NASS using similar methods.

Introduction

In 2004, nearly one-third of the 2.1 million farms in the U.S. had youth less than 20 years of age living on them (NIOSH 2007a). Youth living on farms are often exposed to the many hazards that are associated with the operation of any farm. These hazards are present not only for youth working on the farm, but also to youth who are living on or visiting the farm.

Injuries to youth on farms continue to be an area of concern for researchers and safety and health professionals. An estimated 27,600 injuries occurred to youth on farms in 2004, of which 29% were work-related (NIOSH 2007b). Youth living in the farm household accounted for nearly 19,000 of the total injuries (NIOSH 2007a). The sources of injuries to youth on farms, regardless of their work status, were diverse.

The National Institute for Occupational Safety and Health (NIOSH) began collecting data on youth farm injuries in 1998, and has continued to conduct periodic surveillance of this population using the Childhood Agricultural Injury Survey (CAIS). Using the results from the most recent CAIS, this paper examines the number of youth living on farms during 2006. Analyses of the farm injuries experienced by these youth are also presented. Additionally, this examination will provide a comparison to results from the 2004, 2001, and 1998 farm surveys of non-fatal injuries to youth which used a similar methodology in that it was a national survey of the same population with identical definitions for farm, work, and injury.

Methods

In 2007, NIOSH in collaboration with the U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS) conducted the CAIS, a regionally stratified telephone survey of 50,000 farm households across the United States to collect information on farm-related injuries to youth less than 20 years of age that occurred during the calendar year of 2006. Telephone interviews were conducted from mid-February through the end of March of 2007. Sampling was based on the Bureau of Census geographic regions and value of sales.

The original random sample of 50,000 farming operations for the 2006 CAIS was obtained from the 2002 Census of Agriculture sampling frame. Of this original sample, 38,592 farms were able to be contacted. Of those contacted farms, 2,853 were determined to be out of business, and 27,277 farms completed the survey. The adjusted response rate for the survey was 78%.

For this study, an injury was defined as any event occurring on the farm operation that required at least four hours of restricted activity or required the individual to seek professional medical attention. A farm was defined as any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the Census year. Information was collected on both work and non-work injuries occurring to youth who were either living on the farm, visiting the farm, or hired directly by the farm operator to work on the farm, but excluded injuries to contract laborers. Although the CAIS collected data for all youth on farms, the results and discussion for this paper will focus only on those youth who lived on the farm. A work-related injury was defined as any injury that occurred while performing

activities that had a direct impact on the farming operation as a business, regardless of whether the activity was performed for pay.

For all youth less than 20 years of age, general injury information, such as nature of the injury, body part injured, work-relatedness of the injury, and an injury narrative were collected for up to four injuries per farm. The direct source of the injury and the type of injury event were coded by NIOSH staff from the injury narratives according to the Occupational Injury and Illness Classification System (BLS 1992). Demographic information was also collected for the youth in the farm household.

Sampling weights were calculated based on the total number of farms responding by geographical region, the number of farms reported in the 2002 Census of Agriculture for each region, and gross value of sales. All estimates and variances for both the injury and the demographic data were obtained by the SAS surveymeans procedure (SAS 1999). Estimates and 95% confidence intervals (CI) are presented where the relative standard error does not exceed 33% of the estimate. Injury rates were calculated as the estimated number of injuries, divided by the estimated number of household youth. All rates are expressed in terms of 1,000 household youth. Confidence intervals, at 95%, were utilized to determine statistical significance.

Results

Household Demographics

During 2006, there were an estimated 1.1 million (95%_{CI} 1,097,270 to 1,145,513) youth living on farms in the United States. An estimated 626,770 (95%_{CI} 602,770 to 650,771) youth lived on livestock farms, with the majority (59%) residing on cattle farms. An estimated 494,621

(95%CI 474,378 to 514,865) youth lived on crop farms. When examining the number of youth on farms by the value of sales, the majority of youth (53%) lived on farms with less than \$10,000 of annual sales. An estimated 25% of youth lived on farms with between \$10,000 and \$99,999 in annual sales, and 22% of youth lived on farms earning more than \$100,000. Approximately 51% of household youth were male and 47% were female as shown in Table 1. Table 1 also shows the distribution of household youth on farms by age.

Table 1. National estimates of household youth less than 20 years of age on farms in the U.S. by sex and age, 2006.

Age	Total [†]		Male		Female		Unknown Estimate
	Estimate	s.e. [§]	Estimate	s.e. [§]	Estimate	s.e. [§]	
<10 years	379,751	8,707	197,682	5,779	182,057	5,415	12
10-15 years	397,090	7,553	201,027	5,418	196,063	5,183	0
16-19 years	316,533	6,170	166,955	4,556	149,578	4,449	0
Unknown	28,017		4,305		4,000		19,712
Total [†]	1,121,392	12,305	569,970	8,892	531,698	8,519	19,724

[†] Estimates may not add to the total because of rounding.

[§] Standard Error

An estimated 590,497 (95%CI 571,481 to 609,513) household youth performed work or chores on the farm. The highest proportion of working household youth (45%) was between the ages of 10 and 15 years (Table 2).

Table 2. National estimates of working household youth less than 20 years of age on farms in the U.S. by sex and age, 2006.

	Estimate	s.e. [§]
Total [†]	590,497	9,701
Sex		
Male	340,087	7,057
Female	248,781	6,116
Unknown	1,629	
Age (years)		
< 10	103,610	4,107
10-15	266,121	6,311
16-19	216,621	5,180
Unknown	4,145	

[§] Standard Error

[†] Estimates may not add to the total because of rounding.

Injuries

During 2006, there were an estimated 11,654 (95%_{CI} 9,629 to 13,680) injuries to youth who were living on farms in the U.S., for an injury rate of 10.4 injuries/1,000 household youth. Of these injuries, 66% occurred to males and males had an injury rate nearly twice that of females. Household youth between the ages of 10 and 15 years experienced the most injuries (5,790), followed by youth less than 10 years of age (3,026), and youth between the ages of 16 and 19 years (2,748). Youth between the ages of 10 and 15 years had the highest injury rate. The rates for youth less than 10 years olds and 16-19 year olds were similar. Table 3 shows a more complete breakdown of injuries to household youth and corresponding injury rates.

Table 3. National estimates of injuries and injury rates for household youth less than 20 years of age on U.S. farms, 2006.

	Number of Injuries		Injury Rates*	
	Estimate	s.e. [§]	Rate	s.e. [§]
Total [†]	11,654	1,029	10.4	0.9
Sex				
Male	7,678	895	13.5	1.6
Female	3,886	743	7.3	1.4
Age (Years)				
<10	3,026	505	8.0	1.3
10-15	5,790	850	14.6	2.2
16-19	2,748	673	8.7	2.1
Work Status				
Work	3,601	660	6.1	1.1
Non-work	7,963	898	7.1	0.8

* Injury rate per 1,000 household youth

§ Standard error

† Estimates may not add to the total because of rounding.

The most common type of injury to occur to household youth was a broken bone or fracture (3,007 95%_{CI} 1,715 to 4,299), followed by cuts and lacerations (2,083 95%_{CI} 1,129 to 3,036). The arm (2,736 95%_{CI} 1,513 to 3,959) was the most commonly injured body part, followed by the leg (1,870 95%_{CI} 841 to 2,899) and the hand, wrist, and fingers (1,652 95%_{CI} 662 to 2,642). Structures and surfaces (4,545 95%_{CI} 3,027 to 6,062), which included the ground (4,339 95%_{CI} 2,832 to 5,846), were the most frequent source of injury. Other common sources of injury included animals (2,333 95%_{CI} 1,236 to 3,430) and vehicles (1,941 95%_{CI} 1,056 to 2,827), which were most frequently off-road vehicles (1,360 95%_{CI} 548 to 2,171). Falls (4,697 95%_{CI} 3,174 to 6,220) were the most common type of injury event, followed by contact with objects (3,385 95%_{CI} 2,096 to 4,673) and transportation incidents (1,525 95%_{CI} 760 to 2,290), which were predominately non-highway events (1,456 95%_{CI} 697 to 2,214).

When examining the number of injuries associated with some of the common contributors to injury, an estimated 3,601 injuries were work-related, 2,755 injuries were associated with horses, and 1,492 injuries were associated with ATVs. It is important to note that these injuries were not mutually exclusive.

Work-related injuries

Males experienced approximately 66% (2,364 95%_{CI} 1,308 to 3,421) of the work-related injuries. Youth between the ages of 10 and 15 years experienced the highest number of work-related injuries (2,078 95%_{CI} 991 to 3,164), followed by youth 16 to 19 years of age (1,370 95%_{CI} 619 to 2,122).

Animals were the most common source of work-related injuries for household youth (1,296 95%_{CI} 450 to 2,142). The most frequent type of injury event for working household youth was being struck by an object (1,181 95%_{CI} 461 to 1,900).

Injuries by Region

Youth residing on farms in the Southern region of the U.S. experienced the most injuries (4,955 95%_{CI} 3,371 to 6,539), followed by those in the Midwest (4,257 95%_{CI} 3,120 to 5,395), West (1,641 95%_{CI} 1,153 to 2,129), and Northeast (801 95%_{CI} 550 to 1,052). However, when comparing regions by rate of injury, which takes into consideration the number of youth on farms, there are some differences. The rates by region ranged from 8.7/1,000 household youth in the Midwest to 12.5/1,000 in the South. As seen in Table 4, the injury rate was higher on

livestock farms than on crop farms. This was also true within each region, with the exception of the Northeast, where the injury rates for both crop and livestock farms were similar.

Table 4. Regional estimates of injuries, youth, and injury rates for household youth less than 20 years of age on U.S. farms by type of farm, 2006.

Region	Crop			Livestock		
	Injuries	Household Youth	Rate*	Injuries	Household Youth	Rate*
Total [†]	4,161	494,621	8.4	7,493	626,771	12.0
Northeast	364	36,517	10.0	437	44,720	9.8
Midwest	2,110	260,991	8.1	2,147	229,121	9.4
South	1,172	125,212	9.4	3,783	271,980	13.9
West	516	71,902	7.2	1,125	80,951	13.9

* Injury rate per 1,000 household youth

[†] Estimates may not add to the total because of rounding.

When examining regional injuries by sex, the South had the highest injury rate for both males (15.0/1,000 household males) and females (10.1/1,000 household females). The Midwest and West regions had the largest discrepancy of rates between males and females in the household. Males in the Midwest had an injury rate of 12.4/1,000 household males compared to 4.6/1,000 household females, and in the West the rates were 14.4/1,000 household males vs. 7.0/1,000 household females. The injury rates by sex in the Northeast were similar (10.6/1,000 household males vs. 9.8/1,000 household females).

Comparison to previous CAIS

Table 5 provides a comparison of the number of injuries and injury rates for household youth from the 1998, 2001, 2004 and 2006 CAIS. When comparing the results of this study to results from previous years of CAIS, there was a 57% decrease in the number of injuries to youth

Table 5. A comparison of injuries and injury rates for 1998, 2001, 2004 and 2006 among household youth less than 20 years of age on U.S. farms.

	1998			2001			2004			2006		
	Injury	Youth	Rate									
Total	27,321	1,424,067	19.2	22,144	1,352,948	16.4	18,801	1,256,989	15.0	11,654	1,121,392	10.4
Region												
Northeast	2,095	117,616	17.8	1,184	100,425	11.8	981	86,537	11.3	801	81,237	9.9
Midwest	12,381	686,442	18.0	9,892	601,170	16.5	8,929	517,279	17.3	4,257	490,111	8.7
South	8,385	407,476	20.6	7,858	447,449	17.6	6,065	444,817	13.6	4,955	397,192	12.5
West	4,458	212,533	21.0	3,210	203,905	15.7	2,825	178,356	15.8	1,641	152,852	10.7
Sex												
Male	20,466	746,013	27.4	12,004	672,041	17.9	10,011	639,272	15.7	7,678	569,970	13.5
<10	6,811	249,068	27.3	3,813	220,141	17.3	2,670	217,197	12.3	2,028	197,682	10.3
10-15	8,568	277,794	30.8	6,040	250,522	24.1	4,152	245,739	16.9	4,039	201,027	20.1
16-19	5,087	219,150	23.2	2,150	197,911	10.9	3,079	171,565	17.9	1,612	166,955	9.7
Female	6,855	672,829	10.2	10,140	659,159	15.4	8,789	598,101	14.7	3,886	531,698	7.3
<10	3,482	226,873	15.3	3,655	231,202	15.8	3,573	202,117	17.7	998	182,057	5.5
10-15	2,846	256,891	11.1	4,796	241,752	19.8	3,121	228,228	13.7	1,752	196,063	8.9
16-19	526	189,065	2.8	1,690	182,610	9.3	2,095	163,310	12.8	1,137	149,578	7.6
Age												
<10	10,293	479,214	21.5	7,468	451,353	16.5	6,242	419,650	14.9	3,026	379,751	8.0
10-15	11,414	535,488	21.3	10,836	492,274	22.0	7,273	474,031	15.3	5,790	397,090	14.6
16-19	5,613	409,365	13.7	3,840	380,649	10.1	5,174	334,875	15.5	2,748	316,533	8.7
Work Status												
Work	11,633	816,501	14.2	6,644	725,007	9.2	6,384	698,773	9.1	3,601	590,497	6.1
Male	10,001	486,575	20.6	3,778	411,563	9.2	3,639	404,074	9.0	2,364	340,087	7.0
Female	1,632	329,209	5.0	2,866	312,803	9.2	2,746	293,948	9.3	1,236	248,781	5.0
Non-work	15,687	606,031	11.0	15,500	607,207	11.5	12,395	538,013	9.9	7,963	512,032	7.1
Male	10,465	259,161	7.3	8,226	259,688	6.1	6,360	233,784	5.1	5,313	229,018	4.7
Female	5,222	342,902	3.7	7,274	345,158	5.4	6,035	303,496	4.8	2,650	282,173	2.4
Farm type												
Crop	10,200	689,064	14.8	6,435	518,114	12.4	5,354	460,179	11.6	4,161	494,621	8.4
Livestock	14,616	724,290	20.2	15,709	789,044	19.9	13,346	765,424	17.4	7,493	626,771	12.0
Hazard												
ATV	2,828	1,424,067	2.0	2,093	1,352,948	1.5	1,649	1,256,989	1.3	1,492	1,121,392	1.3
Horse	2,503	1,424,067	1.8	4,754	1,352,948	3.5	4,287	1,256,989	3.4	2,755	1,121,392	2.5
Tractor	3,357	1,424,067	2.4	763	1,352,948	0.6	1,404	1,256,989	1.2	***	***	***

*** Not reportable due to confidentiality requirements.

living on farms from 1998 to 2006. However, there was also a 5% decrease in the number of farms (NASS 2008), and a 21% decrease in the number of youth living on farms. The injury rate for household youth declined from 19.2/1,000 household youth (95%_{CI} 16.3 to 22.1) in 1998 to 10.4/1,000 household youth in 2006 (95%_{CI} 8.6 to 12.2), and was statistically significant. Other categories that showed statistically significant decreases in the rate of injury between 1998 and 2006 included male youth living in the household, youth under the age of 10 years, all work-related injuries, and household male work-related injuries.

The injury rate for household working females remained steady over the time period from 1998 (5.0) to 2006 (5.0). However, the injury rate for household females between the ages of 16 and 19 years more than doubled. This increase was not statistically significant ($p < .05$). A change in household injury rates by region also occurred (Table 5). Three regions, the Northeast, Midwest, and West, have shown statistically significant decreases for household injury rates. Further, the Midwest, which has always had the most youth living in the household, and for the two previous surveys was ranked either first or second in terms of rate of household injury, has the lowest injury rate (8.7/1,000 household youth) in 2006. This decrease drops them below even the Northeast, which has traditionally had the lowest regional injury rate. The South is the only region to not show a statistically significant decrease in the household injury rate, and for 2006, the South had the highest rate of injury for household youth (12.5/1,000 household youth 95%_{CI} 8.5 to 16.5).

The number of youth tractor-related injuries has also declined. In 1998, there were an estimated 3,357 tractor injuries, for a rate of 2.4/1,000 household youth (95%_{CI} .52 to 4.1). By

2004, the rate had dropped by half to 1.2/1,000 household youth (95%CI .44 to 2.0), and in 2006 the number of tractor injuries had declined to a level that is not reportable.

Discussion

Injury surveillance data provide a valuable tool for understanding the causes of injury to youth on farms. Information about the incidence and circumstances of injuries to youth under 20 years of age on farms is needed to target and develop effective injury prevention strategies. This study estimates that in 2006, one out of every 100 youth living on a U.S. farm suffered an injury. A large number of these injuries occurred to youth under the age of 16 years, with half of the injuries reported for youth between the ages of 10 and 15 years. This injury spike by age persists for both males and females, with males 10-15 years of age having an injury rate double that of the other age groups. Future intervention and education efforts should be focused to address this age group.

The number of non-fatal injuries and injury rates are higher for youth on livestock farms than they are on crop farms. This is contrary to what has been reported for fatality data (Hard & Myers 2006). This rate reversal by type of farm could be explained by the types of machinery and tasks that are specific to each type of farming. Further research into this area is needed.

When examining injury rates by region of the country, the South has the highest injury rate for household youth. It is noteworthy to mention that in 2006 the Midwest, which has previously had a high farm injury rate, had the lowest injury rate. An evaluation of safety efforts and

prevention strategies undertaken in this region would be beneficial for use in other regions of the country.

The decrease in injuries and the injury rate from 1998 to 2006 indicates that progress has been made in the area of farm safety for youth on farms. One area of interest is the decrease in injuries for household males, whereas the decrease in the number of injuries to household females has not been as dramatic. Further exploration of this issue is warranted.

Limitations

There are several limitations to the results presented in this paper. First, although the recall period for an injury was less than 15 months and information was collected on more serious injuries, the possibility for recall bias remains. A study of recall for nonfatal injuries for children and adolescents found that although recall bias exists to some degree regardless of the severity of the injury, the effects of recall bias are significantly lower for more severe injuries (Harel et al. 1994). Although CAIS collects data on more severe injuries that required at least four hours of restricted activity or medical attention, the number of injuries reported should be considered a conservative estimate.

The possibility for response bias in this survey also exists. Most of the surveys were conducted with the female head of household and not the injured individual. Further, there was no way to verify the accuracy of the responses given for the survey, which could impart some response bias into the overall survey results.

A final limitation is that in the 1998 CAIS the estimates for age, sex, and work status were adjusted for unknown data. Due to a small number of unknowns, this adjustment was not performed on the subsequent years of CAIS.

Conclusions

The results of this study indicate an overall decrease in the rate of injuries for youth living on the farm; however, farms continue to present a hazardous environment for youth. Horses, work, ATVs and other activities continue to be associated with injuries to youth on farms. Although the declining injury rate appears encouraging, this area will need continued surveillance to assess if it is a significant trend or the result of changing farm demographics. Further, the disparity among the changes in injury rate by age is an area that deserves further research.

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